U. S. DEPARTMENT OF AGRICULTURE
FARMERS' BULLETIN No. 954 Rev. Apr. 1925

THE DISINFECTION OF STABLES

Rev. ed. follows

THE WORK of the Bureau of Animal Industry in dealing with infectious diseases of livestock has shown that the average stockman and farmer does not sufficiently realize the importance of thoroughly disinfecting his premises following an outbreak of contagious disease.

Invisible organisms—germs—of various kinds have been identified by the microscope as the direct cause of many diseases of animals. Unless destroyed these germs have the power to maintain themselves on premises for indefinite periods. So long as they thus remain they are a constant menace and may at any time be the cause of an outbreak.

Proper disinfection destroys disease germs. There is, however, much lack of information concerning the destructive powers of the various disinfectants and the best and most economical ways of using them.

Thoroughness in doing the work is most important. Careless disinfection is little better than none at all, because it does not insure against future trouble.

This bulletin describes some of the more reliable disinfecting agents, together with approved methods of their application.

This bulletin is a revision of Farmers' Bulletin 480

Washington, D. C.

Issued March, 1918
Revised April, 1925

THE DISINFECTION OF STABLES

By GEORGE W. POPE, *Veterinarian, Field Inspection Division, Bureau of Animal Industry*

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THE NECESSITY FOR DISINFECTION

It is but natural to acknowledge the presence of only such objects as can be seen with the unaided eye. Science, however, by means of the high-power microscope, has clearly proved the existence of numerous minute animal and vegetable organisms—microorganisms—and it is a matter of common knowledge that many of these organisms frequently find their way into the animal body and produce disease. It is also well known that these microorganisms, or germs, vary in form and other characteristics and that for each disease of an infectious nature there is a specific germ.

If these germs could be confined to the animal body and die with it there would be no such thing as an infectious disease. Unfortunately, however, they are thrown off by the animal through the excretions and lie in the soil, in the litter of stables, on the floor and walls, and in cracks and crevices. Here they may remain and maintain their virulence for an indefinite period, ready at any time to be gathered up by an animal in its feed or to be blown about in dust and drawn into the lungs.

For example, we have tuberculosis in cattle and glanders in the horse. In the former disease the causative agent is a rod-shaped germ (*Mycobacterium tuberculosis*) which averages about one ten-thousandth of an inch in length. Cattle affected with tuberculosis pass myriads of these germs with the manure, and it is not difficult to understand how in the average stable they would have little difficulty in finding many lodging places.

In glanders the causative agent is another rod-shaped germ (*Pfeifferella mallei*), about the same length as the tuberculosis germ, but somewhat thicker. A characteristic of this disease is the formation of ulcers in the nostrils and other portions of the body, from which there is more or less discharge laden with the glanders germ. And here, again, it is not difficult to understand how one diseased animal may contaminate extensive premises.

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As has been stated, some of these minute forms are vegetable organisms. In fact, these vegetable parasites are the cause of some of the most destructive diseases, and some of them are very difficult to destroy, for the reason that they contain spores. A spore may be likened to the seed of a plant, for it bears about the same relation to the microorganism (bacterium) that a grain of wheat does to the plant proper. As the plant may be destroyed and the seed remain latent for an indefinite time, so destruction of the bacterium may be accomplished while the spores remain unharmed and retain life for weeks, months, or years.

An example of this class of organisms is seen in the agent which causes anthrax (*Bacterium anthracis*). Ordinary methods for the destruction of the bacterium will not destroy the spore as well, and

FIG. 1.—A stable and yard that are very difficult to clean and disinfect

thus anthrax becomes a most difficult disease to eradicate. On farms where animals have died from anthrax and the carcasses have been buried instead of destroyed, repeated outbreaks of the disease may occur from time to time, possibly extending over a period of several years. This condition is due to the existence of the very resistant spores, which, under favorable circumstances, are carried to the surface of the earth and become infecting organisms—much as the seed of a noxious weed, after remaining in the soil during the winter, finds the conditions favorable in the spring and develops into a plant—except that these minute forms of life multiply with the most wonderful rapidity.

Thus it is that our increased knowledge regarding microorganisms or bacteria as the cause of many animal diseases has emphasized the importance of disinfection.

There are also certain diseases caused by small animal parasites which make necessary a careful cleansing of pens and buildings. Among these parasites are various species of mange mites which cause mange or scabies in horses, cattle, sheep, swine, and dogs. These are not truly microscopic in size, but are too small to be seen without the aid of a magnifying glass except by a person with keen eyesight and are entirely different in character from the germs or infecting organisms previously described. Although the mange mite lives on the skin, any corrals, pens, chutes, and sheds which have contained affected animals are likely to become infected and require cleaning and disinfection.

The importance of proper disinfection should not be overlooked where efforts are being made to free animals from internal parasites. Stomach worms and other worms in sheep and roundworms in swine cause heavy losses to breeders and feeders. Premises contaminated with the eggs of such undesirable foes to thrift are due to receive attention in any campaign designed to prevent young animals in the flock or herd from becoming infested.

In the case of parasites the ordinary disinfectants used to destroy the germs of bacterial diseases are of little value in themselves. Destruction of the infective stages of the various kinds of parasites that have been mentioned depends largely on thorough cleansing, including removal of all litter, contaminated soil, manure, etc., the liberal use of scalding water and other means of securing cleanliness. Disinfecting solutions alone do little good, and special attention must be given to the question of cleaning and disinfecting premises when parasitic diseases are involved, or disappointing results are likely to follow.

THE NATURE OF DISINFECTION

The work of disinfection is based on our recognition of the presence of disease germs, and disinfection means the act of destroying the cause of the infection. In other words, disinfection is a removal of the cause, and it will be clear to any practical man that in dealing with disease any effort which stops short of a complete removal of the cause is most unwise and unprofitable. To those unaccustomed to the work, disinfection may seem a most complicated process. Any approved method, however, is comparatively simple when carried out carefully, although like many another procedure it is one in which attention to details counts for much. It is important to bear in mind that the causative agents of many diseases are extremely small and may remain for an indefinite time in dust, cracks, and crevices of buildings, so that efforts aiming at the eradication of disease from contaminated premises must be thorough in order to be effective.

Stables of the kinds shown in Figures 1 and 2 are very difficult to disinfect. On the other hand, a sanitary stable of the type shown in Figure 3 may be thoroughly disinfected with relative ease.

DISINFECTANTS

In the work of disinfection nature has provided man with a most valuable ally—sunlight. It is well known that the direct rays of the sun are inimical to many forms of bacteria, in some cases destroy-

ing them and in others lessening their influence. Thus the importance of well-lighted stables is evident. The dark and sunless building will be a favorable breeding place for bacteria, and the structure which admits the greatest amount of sunlight will be the least favorable for their development. Again, heat will destroy the bacteria of disease. By this is not meant the ordinary heat of the sun, but heat as developed in boiling water or in flame. It is upon this principle that the surgeon before operating renders his instruments free from the possible presence of bacteria by boiling, and it is the heat therein which renders a jet of live steam destructive to bacteria. Sunlight, however, can not be considered more than an accessory in the destruction of bacteria, while the application of heat in the form of steam is seldom possible and the use of a flame torch is not a safe procedure in the average building. Consequently, in the practical work of disinfection we are dependent upon certain drugs which have power to destroy the organisms of disease.

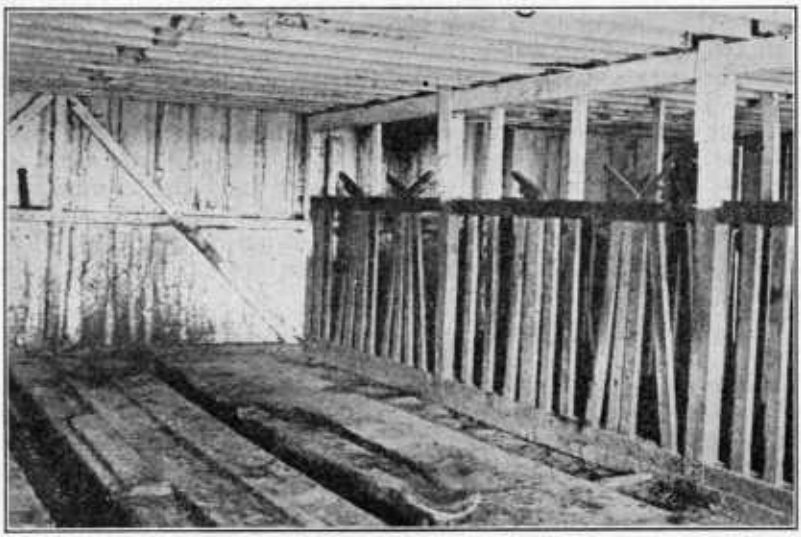

FIG. 2.—Interior of a stable where disease germs find ready lodgment and are hard to reach and destroy. Before disinfection a thorough cleaning would be necessary, involving the removal and burning of some of the woodwork

Such drugs are known as disinfectants, and, fortunately, we have at hand a number that possess the power of destroying bacteria. It is not the purpose here to consider further the relative values of these drugs; neither will it be necessary to discuss the exact manner in which they act. It is sufficient to know that they possess the power of destroying bacterial life with the same certainty that poisonous drugs destroy animal life. They have only to be brought in contact with the bacteria in order to destroy them. As disinfecting drugs vary more or less in potency and in adaptability to general use, possessing certain advantages as well as disadvantages, it may be well to describe briefly a few of the commoner forms.[1]

[1] For fuller details regarding disinfecting agents the reader is referred to Farmers' Bulletin 926, "Some Common Disinfectants," by Dr. M. Dorset, chief of the Biochemic Division, Bureau of Animal Industry, from which some of the information herein given has been derived.

BICHLORIDE OF MERCURY

Bichloride of mercury, known also as corrosive sublimate and mercuric chloride, is used in solution in water, commonly in a strength of 1 to 1,000, though solutions of double that strength may be employed. Although possessing great germicidal power, it has the disadvantages of being a violent poison, of corroding metals, and of uniting with albuminous substances, such as excreta, blood, etc., and thus forming inert compounds. Unlike the coal-tar products, it leaves no odor in the stable, which is an advantage in connection with the production of milk. On the other hand, care must be used in the handling of a solution of this drug, and feed boxes to which it has

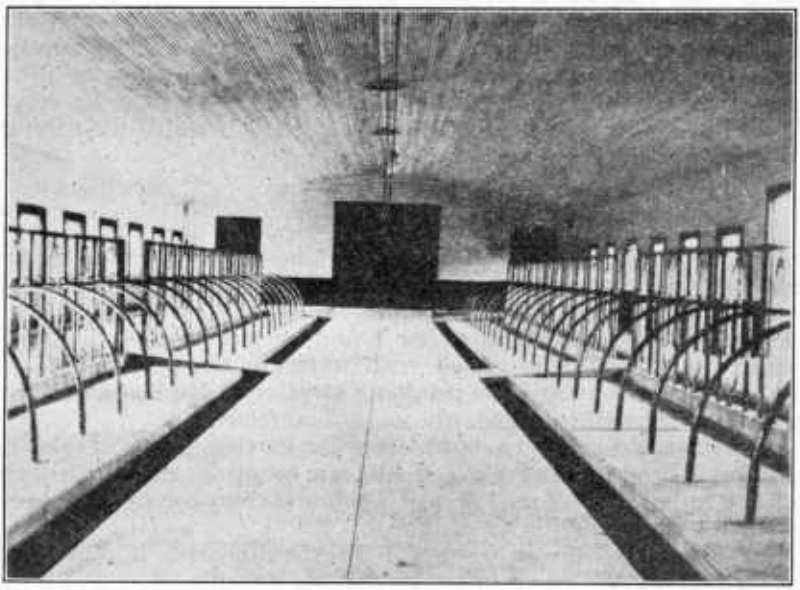

FIG. 3.—A sanitary stable that is relatively easy to clean and disinfect

been applied should be washed with clear water before animals are again permitted access to them.

CHLORIDE OF LIME

Chloride of lime (chlorinated lime) is a well-known disinfectant, although its value is doubtless greatly overrated. This may be due in part to the fact that it is a powerful deodorant—such drugs on account of their pungent order being popularly believed to have great disinfecting power. Being of uncertain strength and somewhat destructive to metals, and having a permeating odor especially objectionable in a stable where milk is produced, chloride of lime can not be classed as the most desirable of disinfectants. For general disinfecting purposes it may be mixed with water in the proportion of 6 ounces to the gallon.

CHLORINE GAS

Chlorine gas, which has long been used in the purification of city water supplies and swimming pools and the disinfection of tannery effluents, has more recently been applied in the treatment of infectious respiratory conditions in both man and animals. This has led to a popular belief that it may be a satisfactory disinfectant for general use. Experiments recently conducted by officers of the Veterinary Corps, Medical Department, United States Army, tend to show favorable results in the control of an outbreak of influenza. Many affected and exposed Army horses in this instance were subjected to the fumes of chlorine in a closed stable. As chlorine gas has marked disinfecting properties, there may be especial cases in which it can be utilized in the disinfecton of stables. The fact, however, that chlorine lacks penetrating power or becomes more or less inert in the presence of organic matter, and the highly corrosive action of this chemical on metals, tend to limit its sphere of usefulness and render general application as a stable disinfectant problematical if not impracticable.

FORMALDEHYDE

An aqueous solution containing approximately 40 per cent of formaldehyde and known as formalin has of recent years become a more or less popular disinfectant.

Formaldehyde is used in either liquid or gaseous form. In the former case formalin is mixed with water in the proportion of 6 ounces to the gallon, and the resulting solution is applied directly to surfaces or substances which are to be disinfected.

Formaldehyde gas is in most cases impracticable for stable disinfection. Where, however, a stable can be made almost air-tight, and the animals removed, it will be found very serviceable, as it penetrates every crevice.

Several methods are in vogue for disinfecting with formaldehyde gas. Probably one of the most simple and practicable is to liberate the gas by means of the chemical reaction which takes place when formalin is poured upon permanganate of potassium. For each 1,000 cubic feet of air space 16⅔ ounces of crystallized or powdered permanganate of potassium is placed in a wide-surfaced pan; 20 ounces of formalin is then poured upon it, and the room immediately closed for a period of 12 hours or longer. This method is efficient only when it is possible to seal tightly the rooms or compartments to be disinfected and when their temperature is not below 50° F.

CARBOLIC ACID

Carbolic acid in its pure form is, at ordinary temperatures, in the shape of long, white crystals. For convenience it is frequently dispensed in liquid form by the addition of 10 per cent of water. A 5 per cent solution of carbolic acid is sometimes used as a disinfectant, but carbolic acid has the disadvantage of being expensive and somewhat difficult to dissolve.

CRUDE CARBOLIC ACID

This substance should not be confused with pure carbolic acid. It is a product of coal-tar distillation and consists for the most part of practically inert oils and cresylic acid. Its disinfecting power depends upon the amount of cresylic acid which it contains, as well as upon the relative percentage of hydrocarbon oils. Owing to its uncertain composition, crude carbolic acid can not be classed as one of the most desirable disinfectants.

CRESOL

Cresol, commonly termed "straw-colored carbolic acid," "liquid carbolic acid," etc., in a 2 per cent solution is an efficient disinfectant. It has the disadvantage, however, of being somewhat difficult to dissolve, so in preparing a disinfectant solution warm water should be used and care exercised that the drug is entirely dissolved. As the disinfecting power of cresol is dependent upon the amount of cresylic acid contained therein, it is essential when using the drug to know the degree of purity. Grades can be purchased under a guaranty to contain from 90 to 98 per cent of cresylic acid. Any containing less than 90 per cent should be rejected.

COMPOUND SOLUTION OF CRESOL

Compound solution of cresol (liquor cresolis compositus), now recognized by the United States Pharmacopœia as an official preparation, is composed of equal parts of cresol (U. S. P.) and linseed-oil-potash soap. It is an efficient disinfectant in a 3½ to 4 per cent solution and has the advantage of mixing readily with water.

"Saponified cresol solution" as prepared by various manufacturers is sometimes used as a substitute for compound solution of cresol (U. S. P.).

Under regulations of the Department of Agriculture only such preparations of "saponified cresol solution" as meet certain requirements are permitted for official disinfection of cars, boats, other vehicles, premises, etc. A list of such permitted disinfectants is furnished by the Bureau of Animal Industry, Washington, D. C., upon request.

DETAILS OF DISINFECTION

In the practical work of disinfection there are three essentials:

1. A preparation of the building that will facilitate reaching organisms of disease.
2. A disinfectant which upon contact can be depended upon to destroy such organisms.
3. A method of applying the disinfectant that will assure the most thorough contact with the bacteria.

PREPARATION OF BUILDING

Before beginning the use of a disinfectant it is essential that certain preliminary work be done in and about the stable that is to be treated. The various surfaces, such as ceiling, walls, partitions,

floors, etc., should be swept until free from cobwebs and dust. Any accumulation of filth should be removed by scraping and scrubbing, using for this purpose a wire or other stiff brush and warm water with a liberal quantity of washing soda. In some cases the woodwork may have become softened and so porous as to be a good medium for the absorption of disease germs. Such woodwork should be removed, burned, and replaced with new material.

All refuse, manure, etc., from stable and barnyard should be removed to a place inaccessible to livestock and, if possible, be burned or thoroughly mixed with a solution of chloride of lime in the proportion of 6 ounces to 1 gallon of water. A good method of cleaning gutters is shown in Figure 4. If the floor is of earth, it will doubtless have become stained with urine and contaminated to a depth of several inches. In such cases 4 inches or more of the sur-

FIG. 4.—Removing manure from gutter preparatory to disinfection

face soil should be removed and treated as suggested above for refuse and manure. All earth removed should be replaced with soil from an uncontaminated source, or better, a new floor of concrete may be laid, this being the most durable and sanitary material for the purpose.

SELECTION AND PREPARATION OF THE DISINFECTANT

Having made ready the field of operation, the next consideration should be the selection and preparation of the disinfectant. The fact must not be overlooked that many agents used for the destruction of bacteria are likewise poisonous to animals and man. In fact, some drugs, although powerful as germicides, are so poisonous as to preclude their general use in the work of disinfection. Among such, as previously stated, is bichloride of mercury, which possesses the

power of destroying not only bacteria, but spores as well. It is therefore essential in deciding upon an agent to select one having a known germicidal strength, properties of solubility, and at the same time possessing a reasonable degree of safety to animals and man.

All things considered, it is probable that some of the coal-tar products best fulfill these requirements. In this class is the compound solution of cresol, already mentioned, a preparation recognized as official by the United States Pharmacopœia and known as liquor cresolis compositus (U. S. P.). This preparation mixes readily with water and will prove a very efficient disinfectant. It should be used in the proportion of at least 4 ounces to each gallon of water.

Another favorable agent is cresol (commercially known as liquid carbolic acid). It is not so soluble as liquor cresolis compositus and should be stirred thoroughly during the process of mixing, which will be facilitated by using hot water. It is advisable to obtain a grade of the drug with a guaranty of 95 per cent pure, and such should be used in the proportion of 2 to 3 ounces to a gallon of water.

As an accessory preparation and for use after the application of the disinfectant it may be advisable to make ready a limewash to each gallon of which there has been added 4 ounces of chloride of lime, or if it appears desirable to use the disinfectant and limewash at one application, the following method may be followed in preparing 5 gallons: Slake 7½ pounds of lime, using hot water if necessary to start action. Mix to a creamy consistency with water. Stir in 15 fluid ounces of cresol (commercially known as liquid carbolic acid) at least 95 per cent pure, and make up to 5 gallons by adding water. In case compound solution of cresol (liquor cresolis compositus) is used, add 30 fluid ounces instead of 15 as in the case of cresol (liquid carbolic acid). Stir thoroughly. If to be applied through a spray nozzle, strain through a wire sieve. Stir frequently when applying and keep covered when not in use.

In case a large surface is to be disinfected it will be advisable to prepare a liberal quantity of the disinfecting solution before beginning the application. Such solutions, however, should not be permitted to remain in receptacles which are accessible to animals.

METHOD OF APPLICATION

The efficacy and economy of the work will depend in a great measure upon the method of applying the disinfectant. Economy requires that the disinfecting solution be applied rapidly; efficiency requires that it be not only spread in such manner as to cover the entire surface requiring disinfection, but that sufficient quantity and force be used to drive the solution into all cracks and crevices.

Where a very limited surface is to be treated, as, for example, one stall, it may be possible to apply the disinfectant in a satisfactory manner by means of a whitewash brush. In all cases, however, the best method of applying the disinfectant and the limewash is by means of a strong spray pump. Such a pump should be equipped with not less than 15 feet of hose, to which may be attached a 5-foot section of iron pipe of the same caliber. With a spraying nozzle at the end of the pipe the operator will be enabled to proceed with the greatest possible dispatch and the least possible inconvenience. Good

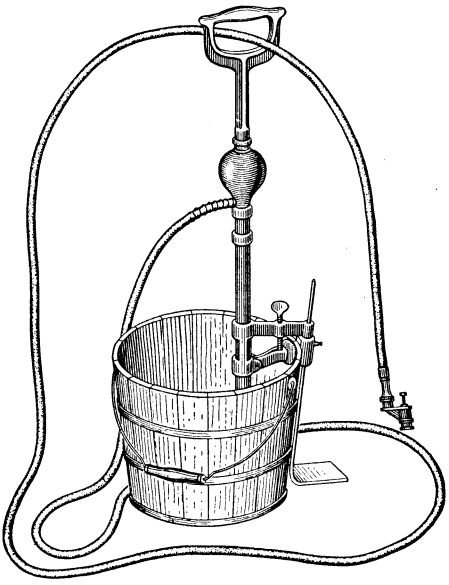

FIG. 5.—Pail spraying pump suitable for disinfecting small stables

types of apparatus are shown in Figures 5, 6, 7, and 8. Figure 9 shows an outfit in use by two men.

The entire interior of the stable should be saturated with the disinfectant. Special attention should be given to the feeding troughs

FIG. 6.—A good type of barrel sprayer

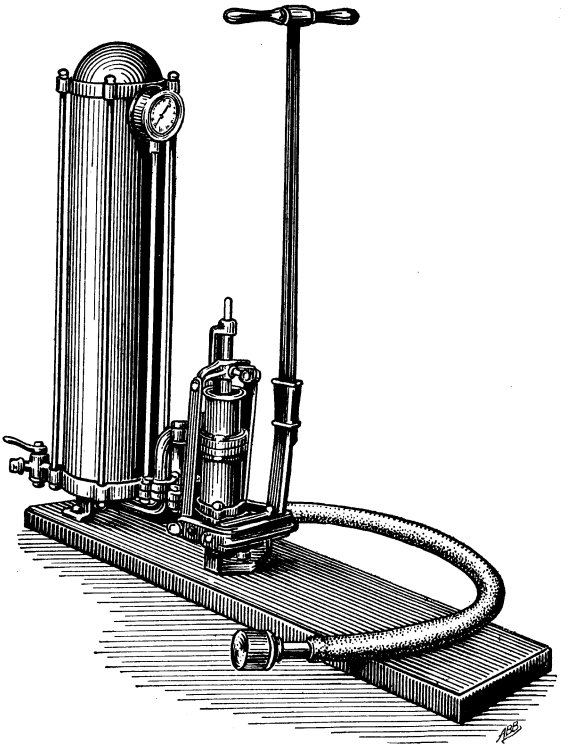

FIG. 7.—A double-acting sprayer, with air chamber

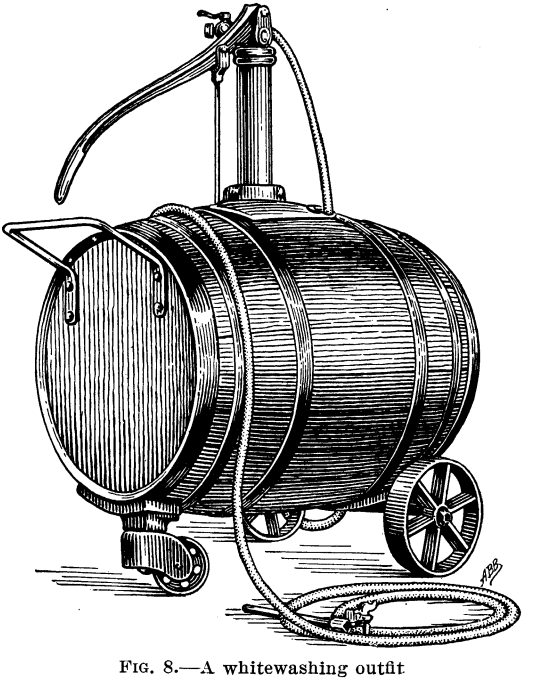

FIG. 8.—A whitewashing outfit

and drains. After the disinfectant has dried, the surface may be sprayed with limewash, provided this has not been combined with

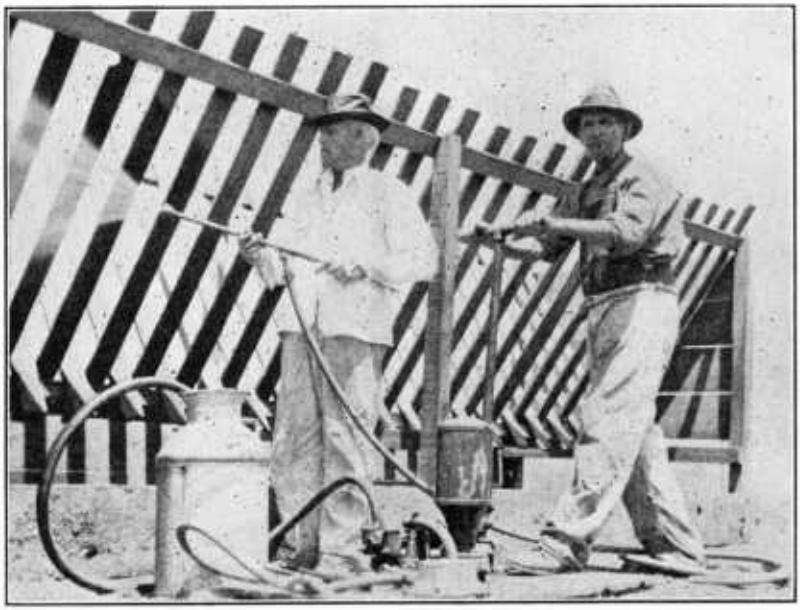

FIG. 9.—Where disinfection is a two-man job

the disinfectant as previously described. When the work has been completed it will be advisable to open all doors and windows of the building for the admission of air and light.

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March 21, 1925

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Bureau of Animal Industry	JOHN R. MOHLER, *Chief.*
Field Inspection Division	A. W. MILLER, *Chief.*

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1925